

4.8 NOISE

This section includes a summary of applicable regulations and a description of ambient noise conditions. It also includes an analysis of noise impacts associated with the implementation of the Central Health Services Center (CHSC) in terms of (1) short-term construction noise; (2) long-term operational mobile source noise; (3) long-term operational stationary source noise; and (4) compatibility of proposed land uses with on-site noise levels. This section also recommends mitigation measures, as necessary, to reduce significant noise impacts.

4.8.1 EXISTING CONDITIONS

ACOUSTIC FUNDAMENTALS

Noise is often defined as unwanted sound. Common environmental noise sources and noise levels are presented in Exhibit 4.8-1. Sound is a mechanical form of radiant energy transmitted by pressure waves in the air. It is characterized by two parameters: amplitude (loudness) and frequency (tone).

Amplitude

Amplitude is the size of the sound wave. It is the difference between ambient air pressure and the peak pressure of the wave. Amplitude is measured in decibels (dB). Since decibels are logarithmic, doubling the source strength does not double the decibel level. For example, a 65 dB source of sound, such as a truck, when joined by another 65 dB source results in a sound amplitude of 68 dB, not 130 dB (i.e., doubling the source strength increases the sound pressure by 3 dB). Amplitude is interpreted by the ear as corresponding to different levels of loudness. Laboratory measurements correlate a 10 dB increase in amplitude with a human perceived doubling of loudness, and establish a 3 dB change in amplitude as the minimum audible difference perceptible to the average person. The normal range of human hearing extends from about 10 dB to about 140 dB.

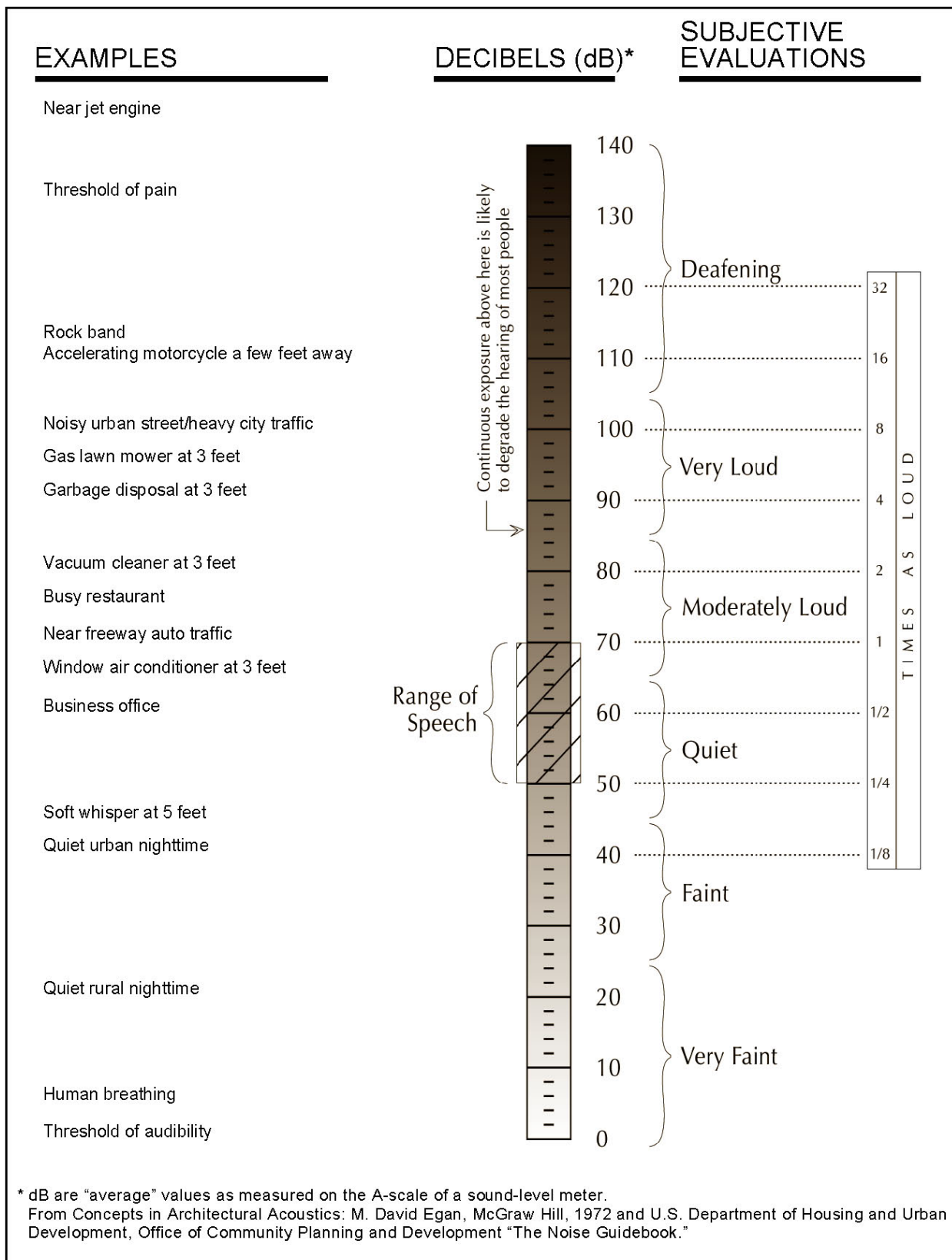
Frequency

Frequency is the number of up and down cycles of a wave per second. The metric for frequency is hertz (Hz). One Hz equals one cycle per second. Humans can hear frequencies ranging from 20–20,000 Hz. The human ear does not perceive each frequency equally. We are more sensitive to sounds within the speech range of 2,000–4,000 Hz. To approximate for this sensitivity, environmental sound is usually measured in A-weighted decibels (dBA). This measurement is used to account for the tuning of our aural system so that we can predict with a higher degree of accuracy what sounds will and will not affect humans.

Noise Descriptors

The intensity of environmental noise changes over time, and several different descriptors of time-averaged noise levels are used. The selection of a proper noise descriptor for a specific source depends on the spatial and temporal distribution, duration, and fluctuation of the noise. The noise descriptors most often used to describe environmental noise are defined below:

- L_{\max} (Maximum Noise Level): The maximum instantaneous noise level during a specific period of time. The L_{\max} may also be referred to as the “peak (noise) level.”
- L_{\min} (Minimum Noise Level): The minimum instantaneous noise level during a specific period of time.
- L_{eq} (Equivalent Noise Level): The energy mean noise level. The instantaneous noise levels during a specific period of time in dBA are converted to relative energy values. From the sum of the relative energy values, an average energy value is calculated, which is then converted back to dBA to determine the L_{eq} .



Common Noise Sources and Levels

Exhibit 4.8-1

- L_{dn} (Day-Night Noise Level): The 24-hour L_{eq} with a 10 dBA “penalty” for the noise-sensitive hours between 10:00 p.m. and 7:00 a.m. The L_{dn} attempts to account for the fact that noise during this specific period of time is a potential source of disturbance with respect to normal sleeping hours.
- CNEL (Community Noise Equivalent Level): The CNEL is similar to the L_{dn} described above, but with an additional 4.77 dBA “penalty” for the noise-sensitive hours between 7 p.m. and 10 p.m., which are typically reserved for relaxation, conversation, reading, and television. If using the same 24-hour noise data, the CNEL is typically approximately 0.5 dBA higher than the L_{dn} .

Characteristics of Sound Propagation and Attenuation

Noise can be generated by a number of sources, including mobile sources, such as automobiles, trucks and airplanes, and stationary sources, such as construction sites, machinery, and industrial operations. Noise generated by mobile sources (e.g., cars, trains) typically attenuates at a rate between 3.0 to 4.5 dBA per doubling of distance. The rate depends on the ground surface and the number or type of objects between the noise source and the receiver. Hard and flat surfaces, such as concrete or asphalt, have an attenuation rate of 3.0 dBA per doubling of distance. Soft surfaces, such as uneven or vegetated terrain, have an attenuation rate of about 4.5 dBA per doubling of distance. Noise generated by stationary sources typically attenuates at a rate between 6.0 to 7.5 dBA per doubling of distance.

Sound levels can be reduced by placing barriers between the noise source and the receiver. In general, barriers contribute to decreasing noise levels only when the structure breaks the “line of sight” between the source and the receiver. Buildings, concrete walls, and berms can all act as effective noise barriers. Wooden fences or broad areas of dense foliage can also reduce noise, but are less effective than solid barriers.

Human Response to Noise

The human response to environmental noise is subjective and varies considerably from individual to individual. Noise in the community has often been cited as a health problem, not in terms of actual physiological damage, such as hearing impairment, but in terms of inhibiting general well-being and contributing to undue stress and annoyance. The health effects of noise in the community arise from interference with human activities, including sleep, speech, recreation, and tasks demanding concentration or coordination. Hearing loss can occur at the highest noise intensity levels. When community noise interferes with human activities or contributes to stress, public annoyance with the noise source increases. The acceptability of noise and the threat to public well being are the basis for land use planning policies preventing exposure to excessive community noise levels.

Human Response to Vibration

The human response to groundborne vibration is similar to that of unwanted noise. It is subjective and varies considerably from individual to individual. Vibration in the community has often been cited as a health problem in terms of inhibiting general well being and contributing to undue stress and annoyance. Vibration can interfere with human activities, including sleep, speech, recreation, and tasks demanding concentration or coordination. Table 4.8-1 shows human perception levels for vibration.

Table 4.8-1 Vibration Perceptibility of Humans¹			
Vibration Source	Threshold of Perception	Perceptible	Strongly Perceptible
Steady-State Vibration	0.012	0.035	0.10
Traffic Vibration	0.019	0.08	0.10
Impulse Vibration	0.035	0.24	0.90
Source: Caltrans 2004			

EXISTING NOISE-SENSITIVE LAND USES

Noise-sensitive land uses are generally considered to include those uses where noise exposure could result in health-related risks to individuals, as well as places where quiet is an essential element of their intended purpose. Residential dwellings, including senior housing, are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Additional land uses such as parks, historic sites, cemeteries, and recreation areas are also considered sensitive to increases in exterior noise levels. Schools, churches, hotels, libraries, and other places, where low interior noise levels are essential, are also considered noise-sensitive land uses.

Noise-sensitive land uses in the project vicinity include both on-site and off-site residential dwellings, the nearest of which include the 82 on-site prison employee residences located within the project site and the inmate housing units located. The noise-sensitive time frame for uses at SQSP is 7:00 PM to 5:30 AM. At 5:30 AM, inmates are awakened; feeding begins at 6:00 AM. Production begins at an onsite mattress factory (vocational education for inmates) at 6:00 AM and produces substantial onsite noise.

The nearest off-site residential dwellings are located in San Quentin Village, approximately 700 feet east and north from the project site. Residential dwellings are also planned for construction along Sir Francis Drake Boulevard approximately 3,000 feet west of the project site. Currently the site has been graded but no residences have been constructed. In both the cases of the residences in San Quentin Village and along Sir Francis Drake, intervening topography, buildings, and security walls block a direct line of sight to the Building 22 and warehouse sites.

EXISTING NOISE ENVIRONMENT

The existing noise environment within the project area is influenced primarily by surface transportation noise emanating from vehicular traffic on area roadways, primarily Interstate 580 (I-580), which is 1,500 feet from the site. Additional transportation-related noise sources are occasional aircraft overflights, pass-bys of watercraft within the San Francisco Bay, and occasional loudspeaker announcements from the address system of San Quentin State Prison (SQSP).

An ambient noise survey was conducted on March 21, 2007 to document the existing noise environment in the vicinity of the project site. The noise survey from July 15, 2004 of a previous EIR of San Quentin was also taken into consideration. Short-term noise-level measurements were taken in accordance with the American National Standards Institute acoustic standards. Measurements were taken for a period of 15 minutes at each location during the nonpeak traffic hours using a Larson Davis Model 820 sound level meter placed at approximately 4.5 feet above the ground surface. Exhibit 4.8-2 depicts the locations at which ambient noise measurements were taken. The daytime A-weighted sound levels measured during each survey are summarized in Table 4.8-2. Based on the measurements conducted, average daytime noise levels (in dBA L_{eq}) in the project vicinity generally range from the upper 40s to the low 50s. Maximum noise levels ranged from the low to upper 60s.

EXISTING TRAFFIC NOISE

Existing traffic noise levels were calculated for roadway segments in the project vicinity using the Federal Highway Administration's (FHWA's) Highway Noise Prediction Model, FHWA-RD-77-108 (FHWA 1978). Refer to Appendix E for traffic noise modeling results. Table 4.8-3 presents the CNEL/ L_{dn} value at 50 feet from the centerline of the near travel lane for existing roadways near the project site. The roadway segments modeled were selected because they represent the locations where the greatest potential increase in project-generated traffic, and consequently potential project-generated noise, would occur. The roadway noise levels presented assume no natural or human-made shielding between the roadway and the noise receptor. As indicated in the table, existing average daily traffic noise levels along Sir Francis Drake Boulevard average approximately 74 dBA CNEL at 50 feet from the



Ambient Noise Measurement Locations

Exhibit 4.8-2

centerline of the near travel lane. Existing noise levels along Main Street are predicted to average approximately 58 dBA CNEL and are approximately 79 dBA CNEL along I-580.

Table 4.8-2 Ambient Noise Measurements					
Location ¹		Time	A-Weighted Decibel Sound Level		
			L _{eq}	L _{min}	L _{max}
1	20 Feet East of Building 22	10:39–10:54 a.m.	55.3	50.1	69.0
2	Employee Housing, Northeast of Project Site	11:35–11:50 a.m.	51.8	43.0	69.1
3	Main St., San Quentin Village (2,100 Feet East)	12:10–12:25 p.m.	56.8	47.1	69.8
4*	Employee Housing; Northeast of Project Site	9:30–9:45 a.m.	49.5	44.2	66.9
5*	Employee House Northwest of Project Site	10:00–10:15 a.m.	47.7	42.3	60.0
Notes: L _{eq} = energy-equivalent noise level; L _{min} = minimum noise level; L _{max} = maximum noise level. ¹ Monitoring locations correspond to those depicted in Exhibit 4.8-2. Noise survey conducted on March 21, 2007. “*” Indicates monitoring from previous survey—July 15, 2004. Source: Data collected by EDAW 2007.					

Table 4.8-3 Calculated Existing Roadway Traffic Noise	
Roadway Segment	Traffic Noise Level (dBA CNEL/L _{dn}) at 50 Feet from Centerline of Near Travel Lane
Sir Francis Drake Boulevard	
West of San Quentin West Gate	73.80
East of San Quentin West Gate	73.68
Main Street, West of Interstate 580	58.16
Interstate 580, East of Main St.	79.39
Notes: dBA = A-weighted decibel; CNEL = community noise equivalent level; L _{dn} = day-night average noise level. Source: Data modeled by EDAW in 2007.	

4.8.2 REGULATORY BACKGROUND

NOISE GUIDELINES AND STANDARDS

Various private and public agencies have established noise guidelines and standards to protect citizens from potential hearing damage and various other adverse physiological and social effects associated with noise. Applicable standards and guidelines are discussed below.

World Health Organization

Since 1980, the World Health Organization (WHO) has addressed the problem of community noise. In 1992, the WHO Regional Office for Europe convened a task force meeting which set up guidelines for community noise. A preliminary publication of the Karolinska Institute, Stockholm, on behalf of WHO, was written in 1995. The

WHO has since finalized these guidelines and in 2000 published the *Guidelines for Community Noise*. The WHO-recommended noise values identified in the *Guidelines for Community Noise* are based on levels of noise that would ensure the protection of health (critical health effect) and minimize levels of annoyance.

The maximum allowable exterior noise levels recommended by the WHO for residential uses are 55 dBA L_{eq} and 45 dBA L_{eq} for daytime and nighttime hours, respectively. To avoid sleep disturbance during the more noise-sensitive nighttime hours, the WHO-recommended maximum exterior noise level at the façade of residential dwellings is 60 dB L_{max} , or 45 dBA L_{max} within interior sleeping areas (WHO 2000).

State of California

The State of California has adopted noise standards in areas of regulation not preempted by the federal government. State standards regulate noise levels of motor vehicles, freeway noise affecting classrooms, sound transmission control, occupational noise control, and noise insulation.

The State has established noise compatibility standards for prisons within Title 15 of the California Code of Regulations. The section states “Housing areas shall be designed and constructed so that the average noise level does not exceed 70 decibels during periods of activity and 45 decibels during sleeping hours.”

The California Sound Transmission Control Standards state that interior noise levels attributable to exterior sources, with windows closed, shall not exceed an annual noise level of 45 dBA L_{dn} in any habitable room.

The State Office of Noise Control provides guidance for the acceptability of projects within specific L_{dn} contours (State Office of Noise Control 1976). Projects that include residential uses, hospitals, churches, libraries, and schools are normally unacceptable in areas in which noise levels exceed 70 dBA L_{dn} , and conditionally acceptable in areas with noise levels between 60 and 70 dBA L_{dn} .

Local Government Standards and Guidelines

Because a State agency (the California Department of Corrections and Rehabilitation [CDCR]) is the proponent agency for this project, compliance with local standards is not required. However, the State considers local noise standards as they relate to the compatibility between the state prison and various land uses adjacent to the project site. Local noise standards are used as guidelines for what the CDCR considers as acceptable noise levels in noise-sensitive areas.

Marin County General Plan Noise Element

The Marin Countywide Plan Noise Element contains policies that address noise-sensitive land uses and standards to avoid noise-related impacts from existing uses and new developments within the unincorporated part of Marin County (County). Table 4.8-4 presents the Marin County Land Use Compatibility for Community Noise Environments.

City of Larkspur General Plan Noise Element

The goal of the noise subelement is to ensure that City of Larkspur residents are not subjected to noise beyond acceptable levels. One of the objectives of the noise subelement is to protect existing noise-sensitive development from new uses that would generate noise levels incompatible with those uses and, conversely, discourage noise-sensitive uses from locating near sources of high noise levels. In its noise element, the City of Larkspur identifies maximum allowable noise exposure for land use compatibility (Table 4.8-5). As identified in Table 4.8-4, residential land uses proposed for development within the City of Larkspur are considered “normally acceptable” at levels less than approximately 55 dBA L_{dn} /CNEL, “conditionally acceptable” between approximately 55 and 70

dBA, “potentially unacceptable” between approximately 70 and 75 dBA, and “normally unacceptable” at levels exceeding 75 dBA.

Table 4.8.4			
Marin County Benchmarks for Allowable Noise Exposure from Stationary Noise Sources			
	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)	
Hourly L _{eq} , dB	50	45	
Maximum Level, dB	70	65	
Maximum Level, dB (Impulsive Noise)	65	60	
Marin County Land Use Compatibility for Community Noise Environments			
	Community Noise Level, L _{dn} or CNEL, dB		
Land Use Category	Normally Acceptable (dB)	Conditionally Acceptable (dB)	Normally Unacceptable (dB)
Residential-Low Density Single Family, Duplex, Mobile Homes	50–60	60–70	70–85
Residential Multifamily	50–60	60–70	70–85
Transient Lodging, Hotels, Motels	50–60	60–70	70–85
Schools, Libraries, Churches, Hospitals, Nursing Homes	50–60	60–70	70–85
Auditoriums, Concert Halls, Amphitheaters	< 50	50–70	70–85
Sports Arenas, Outdoor Spectator Sports	< 50	50–70	70–85
Playgrounds, Neighborhood Parks	50–60	60–70	70–85
Golf Courses, Riding Stables, Water Recreation, Cemeteries	50–65	65–70	70–85
Office Buildings, Businesses, Commercial and Professional	50–65	65–75	75–85
Industrial, Manufacturing, Utilities, Agriculture	50–70	70–75	75–85

Notes:

dB = decibel; CNEL = community noise equivalent level; L_{eq} = energy-equivalent noise level; L_{dn} = day-night average noise level

Source: City of Larkspur 1990

Table 4.8-5		
City of Larkspur Exterior Noise Limits		
Receiving Land Use	Time	Noise Level Not to Be Exceeded for More than 30 Minutes per Hour (dBA)
Residential	7 a.m. to 10 p.m.	50
	10 p.m. to 7 a.m.	40
Commercial	Any Time	60
Exterior noise limit shall be adjusted as follows: +20 A-weighted decibel (dBA): Noise occurs less than 1 minute per hour. +15 dBA: Noise occurs more than 1, but less than 5 minutes per hour. +10 dBA: Noise occurs more than 5, but less than 15 minutes per hour. +5 dBA: Noise that occurs more than 15, but less than 30 minutes per hour. -5 dBA: A steady, audible tone such as a whine, screech, or hum; repetitive or impulsive noise; and speech or music. Source: City of Larkspur Municipal Code, Chapter 9.54, Noise Control Regulations		

City of Larkspur Noise Ordinance

To protect people from severe noise levels, the City of Larkspur has adopted a noise control ordinance. In accordance with the ordinance, it is generally considered unlawful for any person at any location within the City to create, or cause to be created, any noise that exceeds the exterior noise limits, summarized in Table 4.8-5.

Construction activities occurring between 7 a.m. and 6 p.m. Monday through Friday (excluding legal holidays) and between 9 a.m. and 5 p.m. on weekends and legal holidays are exempt from these requirements. In addition, grading, excavation, and fill activities occurring between 7 a.m. and 6 p.m. Monday through Friday (excluding legal holidays) are also considered exempt.

Community Ambient Noise Degradation

In addition to the criteria discussed above, another consideration in defining impact criteria is based on the degradation of the existing noise environment. In community noise assessments, it is “generally not significant” if no noise-sensitive sites are located in the project area, or if increases in community noise level with the implementation of the project are expected to be 3 dBA or less at noise-sensitive locations, and the proposed project would not result in violations of local ordinances or standards.

VIBRATION GUIDELINES AND STANDARDS

Federal—U.S. Department of Transportation

To address the human response to groundborne vibration, the U.S. Department of Transportation, Federal Transit Administration (FTA) has set forth guidelines for maximum-acceptable vibration criteria for different types of land uses. These include 65 vibration decibels (VdB) referenced to 1 microinch per second ($\mu\text{in/sec}$) and based on the root mean square velocity amplitude for land uses where low ambient vibration is essential for interior operations (e.g., hospitals, high-tech manufacturing, laboratory facilities); 80 VdB for residential uses and buildings where people normally sleep; and 83 VdB for institutional land uses with primarily daytime operations (e.g., schools, churches, clinics, offices) (FTA 2006).

Standards have also been established to address the potential for groundborne vibration to cause structural damage to buildings. These standards were developed by the Committee of Hearing, Bio Acoustics, and Bio Mechanics (CHABA) at the request of the U.S. Environmental Protection Agency (FTA 2006). For fragile structures, CHABA recommends a maximum limit of 0.25 inch per second (in/sec) peak particle velocity (PPV) (FTA 2006).

Local—Construction Vibration Noise Level Criteria

Both Caltrans and the U.S. Bureau of Mines have established vibration criteria for both construction related equipment and for blasting. A ground vibration level of 2.0 in/sec has been established for structures. Most blasting and equipment vibration levels are held to a limit of 1.0 in/sec when possible.

4.8.3 ENVIRONMENTAL IMPACTS OF THE PROPOSED PROJECT

THRESHOLDS OF SIGNIFICANCE

The proposed project would have a significant impact if predicted noise levels at nearby noise-sensitive land uses would result in:

- a substantial (i.e., 3 dBA, or greater) temporary or periodic increase in ambient noise levels,
- a substantial (i.e., 3 dBA, or greater) permanent increase in ambient noise levels,
- the exposure of persons to or generation of noise levels in excess of applicable standards or guidelines, or

- ground vibration noise levels exceeding 1.0 in/sec.

Short-term Project Impacts

Construction Noise Impacts

Construction activities associated with the project would temporarily increase the ambient noise level at and adjacent to the project site. Construction noise would primarily result from heavy equipment operations and truck traffic.

Construction equipment associated with projects such as this one typically generate noise levels ranging from approximately 75 to 96 dBA at 50 feet, depending on the equipment being used. Maximum construction noise levels would most likely occur during demolition of Building 22. Although a detailed construction equipment list is not currently available, it is expected that the primary sources of noise would include tractors, backhoes, compressors, bulldozers, excavators, and other related equipment. Table 4.8-6 depicts the noise levels generated by various types of construction equipment. Typical operating cycles may involve 2 minutes of full-power operation, followed by 3 or 4 minutes of operation at lower levels. In addition, construction activities are carried out in stages, with different equipment and noise characteristics depending on the stage of construction and the location of the work within the construction site. During these stages, the character and magnitude of noise levels surrounding the construction site changes as work progresses. Despite the variety in type and size of construction equipment, similarities in the dominant noise sources and patterns of operation exist.

Noise from localized point sources (such as construction sites) typically decreases by about 6 dBA with each doubling of distance from source to receptor. Also taking into account the other on-site buildings, the large security wall that surrounds the property (20 feet high and 2 feet thick), and the topography, the rate of attenuation would be substantially affected. Noise to residences to the east in all but 5 of the eastern group of on-site residences and in San Quentin Village would be reduced by 54 dBA (FTA 2006). The five on-site residences located directly north of the project site have clear line of site views of the proposed CHSC site. Housing units 66 and 112 have clear lines to the half of the top floor of the current Building 22 at 300 feet and units 120, 122, and 124 have clear lines to the entire top floor and half of the first floor at 570 feet. The attenuation rates for these five units would be -35 dBA for units 66 and 112 (half wall attenuation), and 16– to 30 dBA for units 120-124 (one quarter wall attenuation) from the CHSC site and near complete attenuation from the warehouse site. Using an Lmax standard of 96 dBA for maximum instantaneous noise levels these five residences could have noise levels ranging from 61 to 66 dBA Lmax in their exterior. Assuming an average exterior-to-interior noise reduction of 15 dBA (with windows open) predicted interior noise levels at these units could exceed 45 dBA for brief periods of time. Inmate housing would be subject to similar noise levels. However, as described previously, the “workday” begins at San Quentin at 5:30AM. This is when inmates are wakened, and feeding and manufacturing activities begin at 6:00AM. Thus, the noise sensitive time (sleeping time) for residents and inmates at San Quentin is prior to 5:30 AM. No construction activities are proposed to begin prior to 5:30 AM, so noise impacts to noise sensitive land uses at San Quentin would not be expected.

Table 4.8-6 Noise Levels Generated by Typical Construction Equipment		
Type of Equipment	Range of Sound Levels	Suggested Sound Levels for Analysis
	(dBA at 50 feet)	(dBA at 50 feet)
Pile Driver (12,000–18,000 Feet per Pound/Blow)	81–96	93
Rock Drill	83–99	96
Jack Hammer	75–85	82
Pneumatic Tools	78–88	85

Pumps	68–80	77
Dozer	85–90	88
Tractor	77–82	80
Front-End Loader	86–90	88
Hydraulic Backhoe	81–90	86
Hydraulic Excavator	81–90	86
Grader	79–89	86
Air Compressor	76–86	86
Truck	81–87	86
Note; dBA = A-weighted decibel. Source: U.S. Environmental Protection Agency 1971; FTA 2006		

Residences in the Larkspur area and in San Quentin Village would have near complete attenuation based on distance, topographic shielding, building shielding, and masking from other noise sources (Hwy 101, Sir Francis Drake Blvd, etc.).

Construction activities would result in a substantial (i.e., 3 dBA or greater) temporary increase in ambient noise levels at nearby noise-sensitive land uses. However, construction activities would not occur during noise-sensitive time periods. . As a result, construction-generated noise would be considered a less-than-significant short-term impact (4.8-a).

Construction Traffic Impacts

During periods of construction, the proposed project would result in approximately 20 daily truck trips, spread throughout the day and up to 149 vehicles during the construction peak could use Sir Francis Drake Blvd. This would be less than 1% percent of daily traffic on this road. Additionally, construction employee parking during primary construction is anticipated to occur off-site. The daytime percentage of trucks per hour for Marin County is 8.43%, using the 2250 average daily traffic for Main Street. The current daytime truck trips would be 190 trips. The projected 20 trips from construction activities would be well below the doubling of traffic levels needed to create a significant increase (+3 dB) in traffic noise.

Increases in construction traffic attributable to the project would result in a negligible and imperceptible increase (i.e., less than 0.1 dBA) in noise. Increases in construction traffic noise would be less-than-significant (4.8-b).

Construction Vibration Impacts

There are no FHWA or state standards for vibration. The traditional view has been that highway traffic and construction vibrations pose no threat to buildings and structures, and that annoyance to people is no worse than other discomforts experienced from living near highways. However, as previously discussed, a considerable amount of research has been done to correlate vibrations from single events such as dynamite blasts with architectural and structural damage. The U.S. Bureau of Mines has set a "safe blasting limit" of 2 in/sec. Below this level there is virtually no risk of building damage associated with most construction activities, including single-event vibration occurrences such as pile driving (Caltrans 2002). Most blasting and equipment vibration levels are held to a limit of 1.0 in/sec, when possible.

Groundborne vibration levels associated with the project would be primarily associated with the operation of pile drivers and demolition activities. To a lesser extent, the operation of dozers and other heavy motorized equipment would also contribute to short-term groundborne vibration, primarily during initial demo and ground clearing

operations. According to Caltrans measurements the operation of heavy equipment (e.g., dozers, excavators, soil compactors) would not result in vibration levels that exceed the peak particle velocity criterion of 1 in/sec.

The way a building is constructed and its condition determines how much vibration it can withstand before damage appears. According to Caltrans, the architectural damage criterion for continuous vibrations, 0.2 in/sec, appears to be conservative even for sustained pile driving. However, it should be noted that pile driving levels can often exceed 0.2 in/sec at distances of 50 feet, and 0.5 in/sec at 25 feet. For normal residential dwellings, however, pile driving peaks should probably not be allowed to exceed 0.3 in/sec. In addition, extreme care must be taken when sustained pile driving occurs within 25 feet of any building, and within 50–100 feet of a historical building, or building in poor condition (Caltrans 2002).

The construction for the CHSC does not include any pile driving, therefore the main contributor to vibration levels from this phase of construction would be disbursed between all other activities. The planned warehouse phase of the project would include pile driving, but given the that the nearest residences is over 600 feet away and the closest building is 50 feet away no damage or disturbance would occur as a result of pile driving or other construction vibration activities (FTA 2006).

Groundborne vibration levels associated with construction of the project are not predicted to have PPV's exceeding current standards for human disturbance (Table 4.8-1) or structural damage. Therefore, this impact would be less than significant (4.8-c).

Long-term Project Impacts

Increases in Traffic Noise

Implementation of the project would result in a slight increase in traffic to existing roadways. To examine the traffic noise impacts, traffic noise levels associated with the project were calculated for roadway segments in the project study area using FHWA's Highway Noise Prediction Model (FHWA-RD-77-108). Projected traffic noise levels, with and without the project, for Sir Francis Drake Boulevard, Main Street, and I-580 are shown in Table 4.8-7.

Increases in vehicle traffic attributable to the project would result in a negligible and imperceptible increase (i.e., 0.3 dBA) in traffic noise and therefore would be less-than-significant (4.8-d).

Table 4.8-7 Predicted Traffic Noise Levels				
Roadway Segment	dBA CNEL/L _{dn} at 50 Feet		Increase over Existing Levels	Significant Impact?
	Background	Background with Project		
Sir Francis Drake Boulevard				
West of San Quentin West Gate	74.14	74.14	0.00	No
East of San Quentin West Gate	74.03	74.05	0.02	No
Main St., West of Interstate 580	58.37	58.63	0.26	No
Interstate 580, East of Main St.	79.64	79.65	0.01	No
Notes: dB = decibel; CNEL = community noise equivalent level; L _{dn} = day-night average noise level Traffic noise levels calculated at 50 feet from centerline of near travel lane; does not assume shielding. Source: Data modeled by EDAW 2007				

Increases in Stationary Source Noise

Stationary source noise and intermittent noise events attributable to the proposed project include the opening and closing of doors, adult voices, back-up power generators, and maintenance equipment. However, because such noise events occur on an infrequent basis and would be similar to noise events and noise levels already occurring on the project site, noticeable increases in substantial noise levels (i.e., 3 dBA or greater) at nearby noise-sensitive receptors would not be anticipated.

Noise levels generated by stationary heating, ventilating, and air conditioning (HVAC) equipment can range from 55 to 90 dBA at 3 feet from the source (U.S. Environmental Protection Agency 1971). HVAC noise would mostly be generated by fans and large condensers for air conditioning. Regardless of whether the HVAC units are roof-mounted or at ground level, the distance, elevation change, other buildings, and exterior prison wall between the HVAC units and nearby receptors would create a maximum level of 30–35 dBA. This is within regulations for Marin County and the City of Larkspur.

Increases in stationary source noise attributable to the project would result in a negligible and imperceptible increase in noise. Therefore this impact would be less-than-significant (4.8-e).

Land Use Compatibility with Ambient Noise Levels

The State has established noise compatibility standards for prisons within Title 15 of the California Code of Regulations. The section states “Housing areas shall be designed and constructed so that the average noise level does not exceed 70 decibels during periods of activity and 45 decibels during sleeping hours.”

Based on the noise monitoring conducted at the project site, average daytime noise levels currently range from the upper 40s to the lower 50s dBA. Implementation of the proposed project would not result in a substantial increase in traffic noise levels along area roadways (i.e., 3 dBA or greater, see Table 4.8-7, background levels are greater than future conditions for this project), nor would the proposed project result in the placement or operation of any major stationary sources of noise. Intermittent noise events associated with the proposed project would occur on an infrequent basis and for only brief periods of time. Based on the ambient measurements obtained at the project site and assuming an average exterior-to-interior noise reduction of 25 dBA, predicted ambient interior noise levels are anticipated to be less than 35 dBA.

The CHSC is considered a health care facility and therefore should be considered in the context of applicable noise regulations for exterior noise levels under land use compatibility guidelines for hospitals. The ambient noise measurement taken at location number one (Table 4.8-2) indicates that the current noise environment (55.3 dBA) at the location for the CHSC is within the acceptable noise range (50–60, 60–70 dB, Table 4.8-4) for hospitals in Marin County and California, respectively.

Predicted ambient exterior and interior noise levels would not exceed the State recommended daytime or nighttime noise compatibility standards for prisons of 70 and 45 dBA L_{eq} , respectively. The project will not affect the noise environment of the nearby residences (> 0.1 dB) and the noise environment will not affect the CHSC once it is completed. Therefore, this impact would be less-than-significant (4.8-f).

4.8.4 PROPOSED MITIGATION MEASURES

LESS-THAN-SIGNIFICANT IMPACTS

The following impacts were identified as a less-than-significant impact, and therefore no mitigation is required:

- 4.8-a:** Short-term Construction Noise Impacts
- 4.8-b:** Construction Traffic Impacts
- 4.8-c:** Construction Vibration Impacts
- 4.8-d:** Increases in Traffic Noise Levels
- 4.8-e:** Increases in Stationary Source Noise
- 4.8-f:** Land Use Compatibility with Ambient Noise Levels